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1AP20 Rec'd PCT/PTO 02 MAY 2006
PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of

Ken KOIBUCHI et al.

Attn: PCT Branch

Application No. New U.S. National Stage of PCT/JP2004/017221

Filed: May 2, 2006

Docket No.: 127915

For: VEHICLE BODY MOTION REALIZATION METHOD AND APPARATUS

**TRANSMITTAL OF THE TRANSLATION OF THE ANNEXES TO THE
INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY**

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

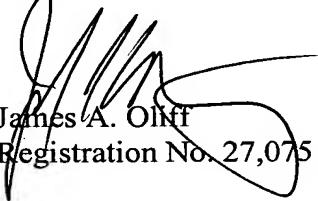
Attached hereto is a translation of the annexes to the International Preliminary Report on Patentability (Form PCT/IPEA/409). Please note the following amendments to (1) the specification, and (2) the claims:

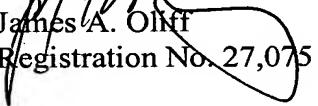
(1) The description "detecting means for detecting state amounts of a vehicle, and a performance function including a direction in which tire generating force acts," shown on page 3, lines 15 to 16 (corresponding to lines 2-4 on page 5 of English specification) has been amended as a description "detecting means for detecting state amounts of a vehicle, state amounts of the vehicle detected by said detecting means, and a performance function including a direction in which tire generating force acts". Further, after "generating force." shown on page 3, line 22 (corresponding to line 12 on page 5 of English specification), the description "The aforementioned performance function is a performance function corresponding to a ratio between a sum of respective squares of the desired vehicle body generating force and yaw moment, and a utilization factor of a road surface frictional coefficient that is a frictional coefficient between a road surface which is supposed to have a constant condition for each of wheels, and a tire." has been added. Pages 3 and 3/1 (pages 4 and 5 of the English specification) have been replaced by substituted sheets of pages 3 and 3/1 (pages 4, 5, and 5/1 of the English specification) submitted as per enclosure.

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(2) The description "detecting means for detecting state amounts of a vehicle, and a performance function including a direction in which tire generating force acts," shown in claim 5, line 1 (line 3 in English claim 5) has been amended as a description "detecting means for detecting state amounts of a vehicle, state amounts of the vehicle detected by said detecting means, and a performance function including a direction in which tire generating force acts". Further, the description "generating force." shown in the last line of claim 5 has been amended as a description "generating force, wherein said performance function is a performance function corresponding to a ratio between a sum of respective squares of the desired vehicle body generating force and yaw moment, and a utilization factor of a road surface frictional coefficient that is a frictional coefficient between a road surface which is supposed to have a constant condition for each of wheels, and a tire". Original claims 1 to 5 have been replaced by substituted sheets of claims 1 to 5 submitted as per enclosure.

Respectfully submitted,


James A. Oliff
Registration No. 27,075


Joel S. Armstrong
Registration No. 36,430

JAO:JSA/jrb

Date: May 2, 2006

OLIFF & BERRIDGE, PLC
P.O. Box 19928
Alexandria, Virginia 22320
Telephone: (703) 836-6400

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generating forces is used.

Accordingly, in the present invention, as the performance function used in the present invention, a performance function corresponding to a ratio between the sum of respective squares of the desired vehicle body generating force and yaw moment, and the utilization factor of a road surface frictional coefficient, which is a frictional coefficient between a road surface which is supposed to have a constant condition, and a tire is used.

In this manner, according to the present invention, a performance function including respective magnitudes of the vehicle body generating force and the yaw moment is used. Therefore, as long as the direction in which the tire generating force acts is calculated from the performance function and is used, the predetermined vehicle body motion can be properly realized regardless of a balance between the magnitudes of the desired vehicle body generating force and yaw moment.

Further, the direction in which the tire generating force acts may be calculated for each wheel by carrying out linearization of restriction conditions of the desired yaw moment and vehicle body generating force and using the performance function. Thus, when the restriction conditions of the desired yaw moment and vehicle body generating force are linearized, calculating load can be reduced.

Specifically, for example, when the aforementioned wheels are four in number with two front wheels and two rear wheels, the direction in which the tire generating force acts on each wheel is obtained by means of a pseudo-inverse matrix of two lines and four rows prepared from the two linearized restriction conditions of the desired yaw moment and vehicle body generating force, and from the performance function.

A vehicle body motion realization method according to the second invention

comprises: calculating means that calculates a direction in which tire generating force acts for each wheel based on detecting means for detecting state amounts of a vehicle, state amounts of said vehicle detected by the detecting means, and a performance function including a direction in which tire generating force acts, so as to realize desired yaw moment and vehicle body generating force for obtaining a predetermined vehicle body motion; and control means that controls a steering angle of each wheel and braking and driving forces of each wheel based on the direction in which the tire generating force acts, which is calculated by said calculating means for each wheel, a value of the performance function used in calculation of the direction in which the tire generating force acts, and a utilization factor of a road surface frictional coefficient, which is a frictional coefficient between a road surface and a tire calculated based on the desired yaw moment and vehicle body generating force. The aforementioned performance function is a performance function corresponding to a ratio between a sum of respective squares of the desired vehicle body generating force and yaw moment, and a utilization factor of a road surface frictional coefficient that is a frictional coefficient between a road surface which is supposed to have a constant condition for each of wheels, and a tire. The vehicle body motion realization apparatus of the present invention has the same operation and effect as those of the invention as described above, and therefore, a description thereof will be omitted.

The calculating means of the vehicle body motion realization apparatus according to the present invention can be made to operate as below as is the case with the foregoing. Namely, the direction in which the tire generating force acts is calculated for each wheel by means of the performance function in which the desired yaw moment and vehicle body generating force are defined as restriction conditions.

In this case, the direction in which the tire generating force acts may also be calculated for each wheel by carrying out linearization of the restriction states of the desired yaw moment and the vehicle body generating force, and also by using the performance function. For example, in a case in which the aforementioned wheels are four in number with two front wheels and two rear wheels, the direction in which the tire generating force acts may be calculated by means of a pseudo-inverse matrix of two

CLAIMS

1. A vehicle body motion realization method in which a direction in which tire generating force acts is calculated for each wheel by means of a performance function including the direction in which tire generating force acts, so as to realize desired yaw moment and vehicle body generating force for obtaining a predetermined vehicle body motion, and the vehicle body motion is realized by using the calculated direction in which the tire generating force acts,

wherein said performance function is a performance function corresponding to a ratio between a sum of respective squares of the desired vehicle body generating force and yaw moment, and a utilization factor of a road surface frictional coefficient that is a frictional coefficient between a road surface which is supposed to have a constant condition for each of wheels, and a tire.

2. The vehicle body motion realization method according to claim 1, wherein the direction in which the tire generating force acts is calculated for each wheel by means of the performance function in which the desired yaw moment and vehicle body generating force are defined as restriction conditions.

3. The vehicle body motion realization method according to claim 2, wherein the direction in which the tire generating force acts is calculated for each wheel by carrying out linearization of the restriction conditions of the desired yaw moment and vehicle body generating force and also using said performance function.

4. The vehicle body motion realization method according to claim 3, wherein said wheels are four in number with two front wheels and two rear wheels, and

wherein the direction in which the tire generating force acts is calculated for each wheel by means of a pseudo-inverse matrix of two lines and four columns, which is prepared from the two restriction conditions of said linearized desired yaw moment and vehicle body generating force and the performance function.

5.(Amended) A vehicle body motion realization apparatus comprising:

calculating means that calculates a direction in which tire generating force acts for each wheel based on detecting means for detecting state amounts of a vehicle, and a performance function including a direction in which tire generating force acts, so as to realize desired yaw moment and vehicle body generating force for obtaining a predetermined vehicle body motion; and

control means that controls a steering angle of each wheel and braking and driving forces of each wheel based on the direction in which the tire generating force acts, which direction is calculated by said calculating means for each wheel, a value of the performance function used in calculation of the direction in which the tire generating force acts, and a utilization factor of a road surface frictional coefficient, that is, a frictional coefficient between a road surface and a tire, which utilization factor is calculated based on the desired yaw moment and vehicle body generating force,

wherein said performance function is a performance function corresponding to a ratio between a sum of respective squares of the desired vehicle body generating force and yaw moment, and a utilization factor of a road surface frictional coefficient that is a frictional coefficient between a road surface which is supposed to have a constant condition for each of wheels, and a tire.